

Ashtabula County: Reach AC 02



About the Program

In an on-going effort to assist property owners along Ohio's Lake Erie coast by providing free technical assistance, the *Lake Erie Shore Erosion Management Plan (LESEMP)* is being developed by the Ohio Department of Natural Resources through a partnership between the Office of Coastal Management, Division of Wildlife and Division of Geological Survey.

The *LESEMP* identifies the causes of erosion in specific areas called reaches which are stretches of shore with similar site conditions. The *LESEMP* then outlines the most likely means of successful erosion control based on reach-specific erosion issues, geology and habitat. The objective of the reach-based approach to erosion control is to simplify the decision process while enhancing the effectiveness of solutions to erosion related issues.

The *LESEMP* does not contain any regulatory oversight provisions.

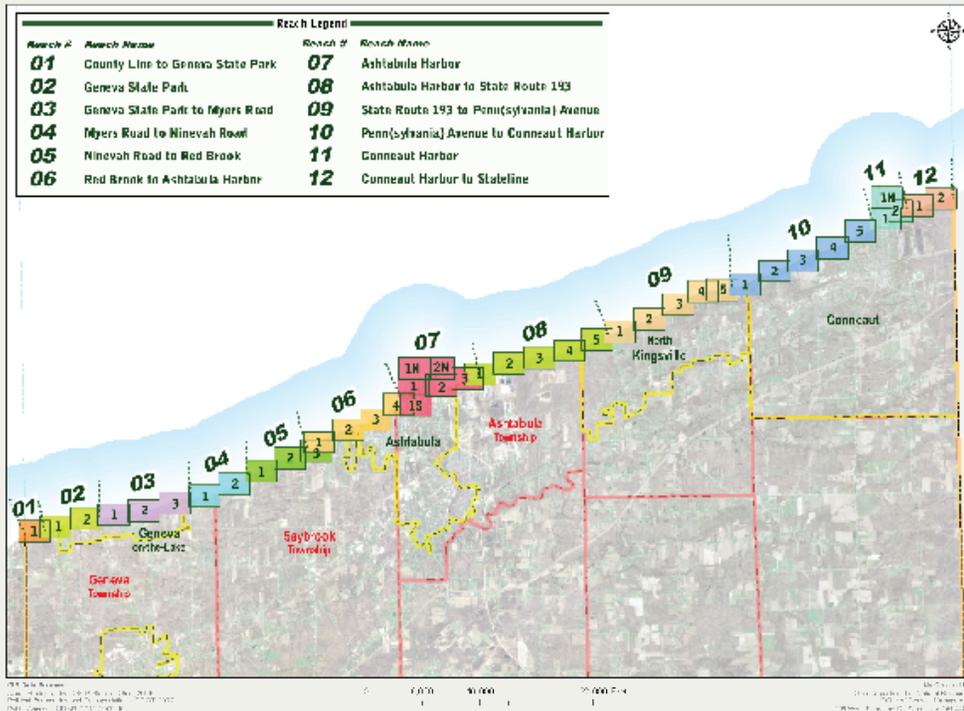
Description

Geneva State Park, a state-owned publicly-accessible park, is a low bank area (roughly 10 to 15 feet in height) composed of till overlain by glaciolacustrine clay and sand. At the western edge of the reach is Wheeler Creek, a tributary to Lake Erie that is frequently sand choked at its mouth, exhibiting a high level of sand in this location. East of the creek is a previously eroding bank that is now protected by a seawall.

Immediately adjacent to the seawall is an undeveloped portion of the park which is fronted by a groin field. Sand is found within the groin field but is absent from the area in front of the seawall. At the marina, there is a beach on the west side of the western breakwater and a small beach formed by a detached breakwater on the east side of the eastern breakwater. To the east of the marina, concrete block and armor stone revetments protect the remainder of the state park property. A small beach is present in front of the area currently occupied by the Lodge, which ranges from Cowles Creek to the groin at the east end of the State Park property.

The major concerns for the Geneva State Park reach include overall sand distribution and availability, with a focus on the beach west of the marina breakwaters and dredging within the marina facility. Concerns about wave erosion along the beach areas may also be included within the category of sand resources. Of interest for sand availability and distribution is the flow of littoral sediment along the shore and nearshore. Littoral drift within this reach moves from west to east. Evidence of this flow of material is found at groins where sediment builds up on the western side of the groin, while the eastern side possesses less sediment.

In addition to the issues present at the toe of the bank, it should be noted that excess surface and ground water can also cause erosion within this reach. Surface water typically causes gullies on the bank, whereas unseen excess ground water can lead to instability between the bank materials which in turn cause slumping.



Recession /Erosion

The ODNR Division of Geological Survey has evaluated the recession of Ohio's Lake Erie shore over three time periods: 1876 to 1973, 1973 to 1990 and 1990 to 2004. Changes between the rates measured in each of the time periods can be attributed to development along the coast and natural factors such as lake level changes. In the first time period, low coastal development persisted throughout Ohio's coast with some of the lowest development rates in Ashtabula County. In the 1970s, development increased causing an increase in the use of shore structures to protect properties. It was during this time that the highest lake levels were recorded and severe storms battered the Ohio coast. This coupling of storms and negative impacts of shore structures led to a general increase in recession rates. In the most recent time period, high lake levels were recorded once again, but the use of better designed shore structures worked to limit the levels of erosion. For the



The 694.5-acre Geneva State Park is Ohio's easternmost state owned and managed public access site on Lake Erie. The park's main Breakwater Swimming Beach extends west from the marina's west breakwater more than 1,770 feet. The beach ranges from 200 feet to less than 50 feet wide.

Learn more: ohiodnr.com/coastal/tabid/22817/default.aspx

purposes of determining recession rates within this reach, the data for each time period for the area of Geneva State Park was analyzed.

Between 1876 and 1973, recession rates within this area were usually less than one foot per year. These relatively low rates are attributed to:

1. an abundance of sand within the littoral system, which contributed to the presence of beaches and relatively gentle nearshore slopes;
2. the relatively flat shale bedrock nearshore that creates a gentle nearshore slope that limits the size and therefore the strength of waves approaching the shore; and
3. the lack of significant numbers of large "stickout" or shore-perpendicular structures that build beaches by trapping sand on the updrift side, but also cause erosion of downdrift areas.

During the 1973 to 1990 time period, average recession rates ranged from 0 to 6.4 feet per year. In the 1990 to 2004 time frame, the rates ranged from 0 to 3.3 feet per year. Two areas of lower recession during these time periods include the western portion of the reach where the cottages are fronted by a seawall and the area in the eastern section of the reach where the lodge is currently located. One location of higher recession is positioned to the east of the cottages and west of the beach built-up by the marina's western breakwater. This section of the reach exhibited higher recession even during the third time period when a majority of the rates throughout the rest of the reach decreased.

Beaches/ Sand Supply

Since sand supply is directly connected to beach presence, the size, number, location and widths of beaches are good indicators of sand supply. Prior to the construction of the state park marina and associated breakwaters (sometime after 1980), sand resources within this reach appeared to be plentiful. Except for the high water levels of the 1970s, beaches were present along most the reach throughout the past half century. The area presently occupied by the marina was a small headland that did not have a beach during higher water levels, but did have beaches updrift and downdrift. After the breakwaters were constructed, the distribution of sediment within the reach changed drastically. Sand began to accumulate

on the updrift side of the breakwaters, while beaches downdrift became smaller. Dredging within the marina became necessary as sand began to build-up inside of the marina breakwaters. Overall, the development of the marina has had a significant effect on the distribution of sand within this reach.

Use of Shore Structures

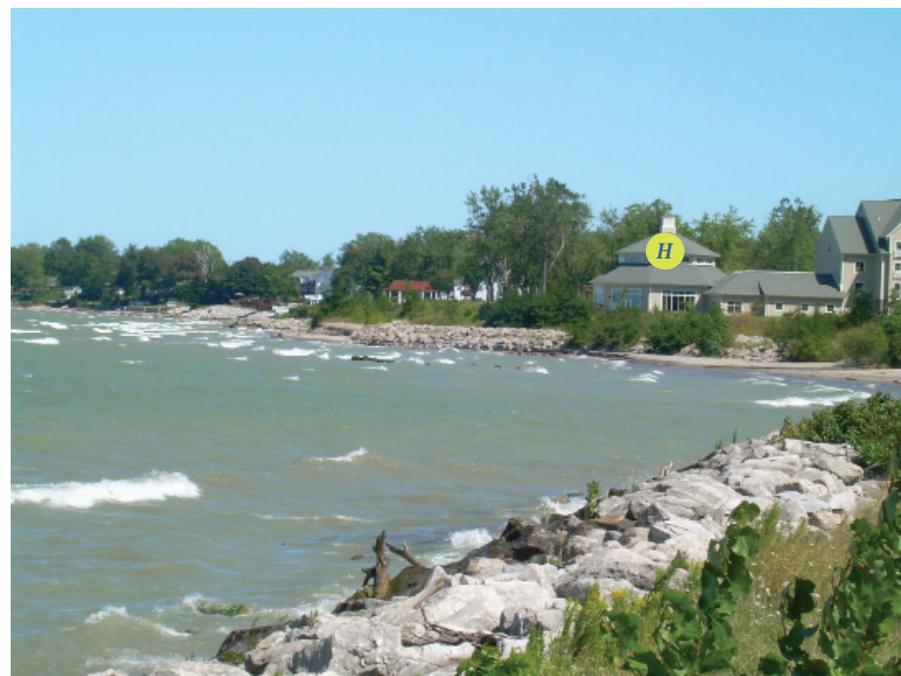
Over the past few decades much of Geneva State Park has changed, causing alterations to the shore and nearshore dynamics. Perhaps the most significant change is the addition of the marina and its two breakwaters. The breakwaters have created a wide beach immediately updrift (west) of the western breakwater and a slight embayment, which is now armored, downdrift (east) of the eastern breakwater. In addition to the marina, the seawall around the far western cottages was added between 1973 and 1980. The area to the east of the marina contained a small beach in front of the mouth of Cowles Creek just west of the lodge. The area that presently contains the lodge was largely undeveloped.

Summary

Geneva State Park is a low bank reach containing a variety of shore structures. Many changes have occurred in this area in recent decades, including the installation of a seawall in front of the western cottages, a marina, two breakwaters at the marina, an offshore breakwater east of the marina breakwaters, and revetments along the eastern half of the park property. Sand within this reach is evidenced by the presence of beaches. Relative to the other beaches within the bounds of the state park, the smallest beaches are located in front of the lodge, between Cowles Creek and State Route 534, and in front of the marina along the east side of the eastern breakwater. The beaches formed by the groin field just east of the cabins are moderately sized, similar to the beach found on the west side of the cabins at Wheeler Creek. The largest of the beaches within this reach is located on the west side of the western breakwater for the marina. This beach is the longest and widest within the state park. Issues with the distribution of sand resources have been a noted concern in the recent past at this location, with most of the troubles related to the movement of sand around the marina breakwaters as exemplified by the large beach updrift of the marina.



*These photos show a portion of Geneva State Park east of the marina. The 109-room resort Lodge and Conference Center at Geneva-on-the-Lake is shown in both pictures and marked with the **H**.*



Reach AC 02 - Geneva State Park

Map 1



Legend

- Reach Boundary
- County Boundary
- Municipal Boundary
- Township Boundary
- U.S. Route
- State Route
- County Road
- Public Access
- Township Road
- Municipal Street
- Park Road

GIS Data Sources:
 Aerial Photography - OSIP, State of Ohio, 2006
 Political Boundaries and Transportation - ODOT, 2007
 Public Access - ODNR OCM, 2009-10



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 Office of Coastal Management
 105 West Shoreline Dr, Sandusky, OH 44870

Reach AC 02 - Geneva State Park

Map 2



GIS Data Sources:
 Aerial Photography - OSIP, State of Ohio, 2006
 Political Boundaries and Transportation - ODOT, 2007
 Public Access - ODNR OCM, 2009-10

0 250 500 1,000 Feet

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Recommendations for Reach AC 02

The recommendations included below are options that may be applicable to properties within this reach and should only be used for planning purposes. Based upon the above physical characteristics, the following recommendations are suggested for Geneva State Park. Each recommendation includes a brief overview of the solution prior to addressing areas within the reach where the recommendation is best suited. For more information on any of the items listed below, please refer to the Glossary and Erosion Control Solutions.

Sand Management:

1. ***Conserve Sand Resources:*** *Conserve sand resources within the shore and nearshore areas. Sand is a limited resource in constant fluctuation. Avoid removing sand from the system; sand moved or excavated during construction along the shore should be placed in the nearshore, not on the upland and should not be incorporated into the construction project.*

This recommendation is applicable to the entire length of the Geneva State Park reach. Sand is found throughout the reach, which is not the case for all of the reaches within Ashtabula County; therefore it should be conserved to the greatest extent possible.

2. ***Beach Nourishment:*** *Supplement the current sand supply with beach nourishment, also known as beach fill or pre-fill. Beach nourishment can increase the size and effectiveness of existing beaches. Additionally, beaches protected by groins and detached breakwaters will benefit from initial nourishment (pre-fill during or directly after construction) and periodic re-nourishment. The sand used in these projects should be acquired from an upland source.*

Beach nourishment would be the most beneficial in front of the lodge at the eastern end of the reach. Due to the shore-orientation of this location (tending toward southwest by northeast), it is less likely to receive the damaging northeastern winds and waves which can often cause more damage to a beach than other storms. Additionally, beach nourishment previously occurred at the lodge, and a more successful long-term result of retaining a beach will likely occur if future renourishment efforts continue at this location. Should a larger beach be desired, beach nourishment could be coupled with detached breakwaters to create a more stable environment

for sand deposition.

Another potential location for beach nourishment is at the western end of the reach, where the groin field is currently located. Specifically, the area just to the east of the seawall has been continually eroding and may require erosion control measures to limit future erosion. One potential solution to controlling erosion in this area is beach nourishment with the continued use of the groin field. If this option is preferred, some repairs will likely be required on the groins. A second option would be to remove the groins and place detached breakwaters throughout this stretch of shore. Beach nourishment would be part of the detached breakwater project. By using detached breakwaters and beach nourishment, there is potential for beach formation; and with the cottages located nearby, there would likely be recreational use of a protective beach in this section of the park.

Beach nourishment is not suggested for the large beach updrift of the marina's western breakwater, nor is it necessary for the beach area created by the detached breakwater on the east side of the marina's eastern breakwater. Both of these locations have shown an increase in beach size over the years, and will likely increase in size or remain stable over future years.

Throughout the reach, any new or modified shore structures may also need pre-fill to enhance the structure's success while limiting downdrift effects.

3. ***Sand Bypassing:*** *Move sand from areas of excess accretion, usually updrift of a shore perpendicular structure, to areas downdrift. By redistributing sand within the nearshore system, the littoral drift in the area will be more evenly dispersed.*

Sand bypassing at Geneva State Park should occur around the marina breakwaters. Sand that is accumulating on the updrift side of the western breakwater, and sand captured between the western breakwater and western

Sand is a limited resource in constant fluctuation. Sand used in projects should be acquired from an upland source.



Above, the Geneva State Park Marina is viewed from standing atop the 500-foot east breakwater. Below, sand is being bypassed from within the marina entrance to the east of the marina's eastern breakwater.



jetty could be moved to the east side of the eastern breakwater. This will add sand into the nearshore areas downdrift including immediately in front of the lodge. Sand bypassing will also limit the amount of sand that accumulates along the beach west of the breakwaters. In turn this will limit the amount of sand that reaches the top of the breakwaters and enters the boating channel. Less sand entering the channel will reduce the need for dredging. Additionally, the reduction of sand going around the breakwaters will limit the amount of sand lost offshore. Once sand reaches a certain depth offshore it will no longer move along the shore and will not build beaches downdrift.

Any sand bypassed around the Geneva State Park marina should be placed as close to shore as possible to ensure it will not be lost from the system. Once the sand is lost to the offshore environment, it can no longer be used for beach building which is a means of naturally protecting the shore from erosion.

4. Dredging: *Dredge marinas and harbors on as frequent a basis as possible to add sand into the littoral system. Dredging of navigation channels at harbors and marinas enhances navigation for boaters, and provides sand for downdrift areas when placed along the shore. When dredged material is disposed of on the upland or in offshore areas, the material is no longer a benefit to the littoral system. In-lake placement is preferred as long as the sand meets the grain size and total organic carbon criteria. Uncontaminated dredge material that is composed of sand and gravel should be placed in the nearshore through sidelaying or placing downdrift. Placing sand in shallow water keeps the sand in the nearshore environment and the littoral system. Sand placed into deeper waters will likely be lost to the littoral system and will not nourish downdrift beaches.*

The dredging of the marina at Geneva State Park is already an ongoing activity. Should the dredged materials be suitable for the nearshore environment, nearshore placement would be highly beneficial to the eastern park property and potentially neighboring properties to the east.

Toe Protection:

5. Detached Breakwaters: *Detached breakwaters may be useful in areas where beaches are present or likely to form. Detached breakwaters aid in retaining a beach by limiting the wave energy reaching the shore causing sediment to settle out and be deposited. As opposed to groins which trap sand moving along the shore, properly designed and constructed detached breakwaters are intended to allow alongshore movement of sand. An initial beach nourishment (pre-fill) and periodic re-nourishment will often be advantageous to creating and retaining the beach landward of the breakwater while limiting impacts to neighboring shorelines. Some regulatory agencies may require pre-fill and periodic nourishment as one of the design components for a project that includes detached breakwaters.*

Detached breakwaters will function well throughout this reach. Specifically, these structures could be constructed along the western portion of the reach where the groin field is currently located, and could be placed in front of the lodge along the eastern portion of the reach. Both of these locations show slight beach formation, mainly due to shore perpendicular structures, but could benefit greatly in terms of beach building with the presence of detached breakwaters. Coupling detached breakwaters with beach nourishment will provide the greatest benefits to both locations.

6. **Revetments:** *Revetments along the toe of a bank will aid in protecting against wave-based erosion. In areas without beaches, a structural measure may be necessary to protect the toe of the bank. The low-relief banks within this reach have relatively gradual slopes, which are ideal for revetment development. In essence, the revetments form a stable bank slope, providing protection to the soil underneath while breaking up wave attacks. Since material eroded off the bank is one source of beach-building sand, some regulatory agencies may require that one of the design components for a revetment be the inclusion of sand pre-filling in the amount equal to that which would have been added to the system over the life of the structure.*

Revetments are already present within the Geneva State Park reach, found along the eastern portion of the marina facility running through to the eastern boundary of the reach. Should greater toe protection be necessary along western portions of the reach, a revetment could be considered as one potential option.



The revetment shown in this photo is just northeast of the Geneva State Park Marina entrance. A narrow pocket beach has accumulated at an embayment in the revetment adding to the effectiveness of the structure.

Bank Modifications:

7. **Re-Grading/ Terracing:** *Re-grade or terrace less stable banks to a more gradual slope. By creating a lower (flatter) slope angle or terracing the slope to a series of steps, instability caused by gravity's forces on the upper bank is decreased. Re-grading is a non-structural approach to stabilize the bank that leaves the shore relatively unaltered. When re-grading, also examine the toe of the bank to determine if toe protection is needed and if a structural (revetment) or non-structural (beach nourishment) solution would be preferable.*

One key location for re-grading within this reach would be the area currently undeveloped and fronted by the groin field. This area appears to have the highest banks and the greatest potential for slumping. Re-grading the banks along this stretch of shore may limit future erosion, and create a more stable environment for future use of the area. A re-graded bank should be vegetated to limit short- and long-term erosion.

8. **Surface Water Management:** *Route surface water away from the face of the bank. In areas where gullies or rills are forming, surface water is slowly eroding the face of the bank. Re-routing water away from the bank may involve changing gutter or driveway drainage. Terracing of the bank can also be used as a means of intercepting and diverting seeping ground water. Sources of surface water include, but are not limited to roof gutter downspouts, runoff from driveways and sidewalks, precipitation, and sprinkler systems.*

The re-routing of surface water should occur throughout the Geneva State Park reach. For instance, limit runoff from the parking lot near the beach along the west side of the western breakwater. Runoff may also be more pronounced near the lodge due to a higher level of development. Attention to the signs of surface water will allow for early action on limiting erosion due to runoff.

9. **Ground Water Management:** *Remove ground water from within the bank. Drainage should be installed in areas with excess water in the bank which are visible as seeps or springs in the middle of the bank. A subsurface drainage system should remove water from an upper layer within the bank (often a sandy layer), and should exit at the lake level to limit lower bank erosion. Sources of ground water include, but are not limited to leaking septic systems, underground pipes and swimming pools.*

While ground water issues may arise throughout this reach, they may be

most noticeable along the higher relief area fronted by the groin field. In this location, a drainage system may be necessary to reduce erosion of the bank due to ground water discharge. Areas fronted by a seawall or revetment may not notice ground water issues until failure of the structures. Caution should be paid to areas where erosion is noticeable directly behind the structures as that may be a sign of surface and/or ground water erosion.

10. Vegetation: Encourage growth of vegetation along the bank slope.

Where possible plant vegetation, preferably native species, along the bank to remove excess ground water while retaining soil strength. It is also possible to simply allow the natural succession of native plant species to grow along the bank.

Should the bank along the currently undeveloped portion of this reach be re-graded or terraced, the planting of vegetation along the newly created bank face will significantly increase the stability of the bank. Vegetating a newly re-graded bank will also limit short-term erosion of the top soil from surface water runoff during and directly after the construction activities.

Management and Monitoring:

11. Bank-Top Management: Keep heavy materials, equipment and structures well back from the edge of the bank-top. This applies to the placement of debris/yard waste near or over the edge of the bank/bluff. Shrub and grass clippings can become saturated with water and greatly increase the weight on the bank slope, directly causing slumping. Any structure (concrete decks, stone walls) or heavy object (vehicles, boats) placed near the bank edge will increase the stress within the soil and can lead to slope failure.

This recommendation is applicable to the entire Geneva State Park reach.



Cowles Creek, a Lake Erie tributary, crosses the narrow pocket beach that is east of the Geneva State Park Marina. To the west of the creek is the revetment shown on the previous page. To the east is the shore fronting the lodge and conference center.

12. Coordination of Projects: Continuation of similar erosion control measures along a stretch of shore will often yield more effective protection than the installation of multiple types of structures adjacent to one another. Most erosion control measures function better when used over large areas of the shore.

Since Geneva State Park is a reach unto itself, there is only one property owner, making the coordination of erosion control projects all the more feasible. Future efforts to control erosion along the shore should consider the size of the project so as to incorporate multiple sections of the park, thereby increasing the efficiency of the new measures. This may include a larger series of detached breakwaters as opposed to only a few. The neighboring control measures should also be considered when conducting future efforts. Beach nourishment next to the already large beach west of the marina may be a feasible option when combined with offshore breakwaters. Instead of placing a revetment in this location, consideration is given to the high level of sand already present and the potential to connect a new project to the current beach.

13. Water Management-Monitoring: Monitor the bank for any changes to the amount/flow of water. Any changes in water patterns on a bank could be signs of potential future failure planes (i.e. areas of slumping or sliding). Regular monitoring of the bank will allow for the early detection and correction of these smaller problems, which will likely be less costly than measures taken after the issues worsen.

Similar to all reaches within Ashtabula County, the Geneva State Park reach must give consideration to the high levels of surface and ground water present within the region. The entire county receives more precipitation than counties to the west, and therefore will always need to be aware of water on and within the banks. Careful monitoring throughout this reach will allow for pro-active measures to reduce excess surface and ground water.

14. Shore Structure Management- Monitoring: Monitor and maintain shore structures. Routine monitoring of shore structures will allow for early detection of any potential failures. Smaller repairs performed more frequently will be less costly and can often increase how long the structure will be effective at controlling erosion. If removal of an aged or deteriorating structure is necessary, consider the above recommendations as potential future solutions.

Since there are a variety of structures used throughout the Geneva State Park reach, all of which were built in different years, routine monitoring and repair of structures is necessary to ensure structures are efficiently functioning. The groin field along the eastern portion of this reach is in greatest need of repair and removal. Given the age and current condition of the groins, removal should be considered along with the placement of new erosion control measures. New measures constructed at the site should consider the options listed above including structural and non-structural solutions. A combination of recommendations may be the most likely solution. Combination solutions may include re-grading and revetment development or the construction of a detached breakwater and pre-fill. Also consider if incorporating a drainage system into the bank is necessary because those systems can be installed while other construction is occurring, limiting the time the bank is disturbed.

References:

- Carter, Charles H. and Donald E. Guy. Report of Investigations No. 122, Lake Erie Shore Erosion, Ashtabula County, Ohio: Setting, Processes, and Recession Rates from 1876 to 1973. State of Ohio, Department of Natural Resources, Division of Geological Survey, Columbus, 1983.
- Ohio Department of Natural Resources, 1998 Final Coastal Erosion Area (CEA) Mapping
- Ohio Department of Natural Resources, 2010 Final Coastal Erosion Area (CEA) Mapping

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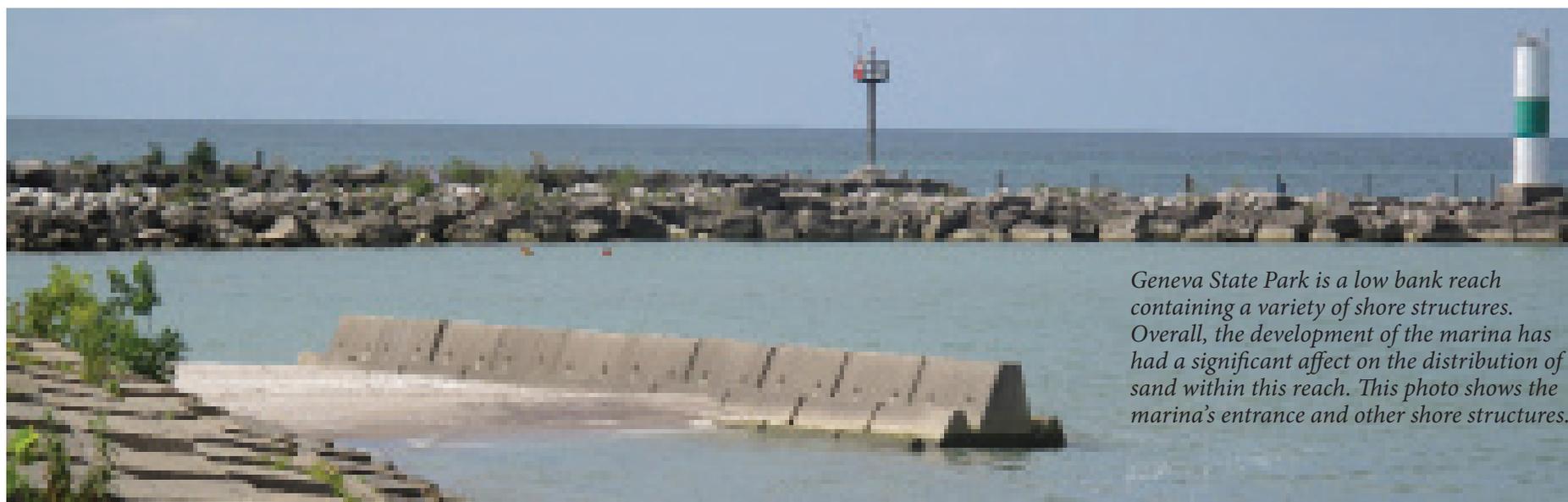
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Geneva State Park is a low bank reach containing a variety of shore structures. Overall, the development of the marina has had a significant affect on the distribution of sand within this reach. This photo shows the marina's entrance and other shore structures.